

Course: Human Computer Interface (HCI)

Week 9: Graphical User Interfaces

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Lecture Learning Outcomes

At the end of this lecture, the learner will be able to:

- (i) Define Graphical User Interface and related concepts
- (ii) Describe the various HCI interfaces
- (iii) Discuss the implications of cognitive aspects in designing interactive computing

Introduction:

What is a User Interface?

User interface refers to the point of contact between computer systems and the users (the person using the computer) and there are different types of interfaces that HCI designers can choose from in their programs or systems.

Graphical User Interfaces (GUI)

GUI accepts input through the use of devices such as computer keyboard and mouse to provide an articulated graphical output on the computer monitor¹. A GUI represents the information and actions available to a user through graphical icons and visual indicators such as secondary notation, as opposed to text-based interfaces, typed command labels or text navigation². The actions are usually performed

¹ Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 331

² Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg. 482

through direct manipulation of the graphical elements. GUIs allow users to interact with electronic devices using images rather than text commands. GUIs can be used in computers, hand-held devices such as MP3 players, portable media players, gaming devices, household appliances and office equipment³.

Other Interfaces in HCI

A. Web-based user interfaces or Web user interfaces (WUI)

These are subclasses of GUIs that accept input and provide output by generating web pages which are transmitted via the Internet and viewed by the user using a web browser program.

B. Touch screens

These are displays that accept input by touch of fingers and they are used in mobile devices, point of sale devices, industrial processes and machines and many other self-service machines.

C. Touch user interface

These are Graphical User Interfaces that use a touchpad or touch screen display combined as input and output devices. They supplement or replace other forms of output with feedback methods and they are used in computerized simulators etc.

D. Command Line Interfaces (CLI)

Users provide the input by typing a command string with the computer keyboard and the system provides output by printing text on the computer monitor. CLIs are used by programmers and system administrators, in engineering and scientific environments, or by technically advanced computer users⁴.

³ Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg 17, 45

⁴ Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg 17, 45

E. Direct manipulation interfaces

This is a human-computer interaction style which involves continuous representation of objects of interest and rapid, reversible, incremental actions and feedback⁵. The intention is to allow a user to directly manipulate objects presented to them, using actions that correspond at least loosely to the physical world⁶.

Impact of cognitive aspects in the design of interactive computing

When designing a system with GUI in mind, the designer should have both the physical and psychological factors of the user in mind.

Importance of cognitive psychology in designing usable and useful interactive computing systems

Some of the cognitive factors that designers need to look at include:

- ✓ Helps in managing user attention
- ✓ Perception & recognition
- ✓ Memory
- ✓ Reading, speaking and listening
- ✓ Problem solving & decision-making

Color theory in Interface Design

When designing a system, a designer needs to provide colours for different items that are to be presented. Colour is used for a number of purposes in the design of interface including⁷: -

- (i) **Drawing attention.** Colour offers rich visual feedback, and can also provide an important communication tool when used consistently.
- (ii) **Improving navigation and scanning speed.** Used consistently, colour can help users to navigate and promptly find desired information.

⁵ Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 232

⁶ Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg 23

⁷ Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 64

- (iii) **Showing relationships.** As mentioned previously, colour provides another perceptual layer and can be used to reinforce groupings
- (iv) **Segmentation:** color is a powerful way of dividing a display into separate regions. Areas/items belonging to each other should have the same color (law of similarity). However, HCI designers need to avoid **colour pollution** whereby, too many colours are used and these increases item search time⁸.

Metaphor in the design of interfaces

A **metaphor** is a pictorial representation of areal object that convey an abstract concept in a more familiar and accessible form. Metaphors are widely used to make use of users' existing knowledge when learning new computer systems. Metaphors give an idea of some unknown thing or concept, by illustrating it with something else which is known and which originally has nothing to do with it.

Current user interfaces are based on several unmistakable metaphors that are very intuitive such as folders for data storage, trash bin for unwanted items etc.

Domains of Metaphor:

- ✓ Functionality (e.g., email - office mail)
- ✓ Interface (e.g., paperclip for attachment)
- ✓ Interaction (e.g., direct manipulation, agent)

Challenges & benefits associated with the use of metaphors in the design of an interaction style

- a) Benefits: users easily develop mental objects
- b) Limitations: translation & conceptual problems, provoke inappropriate actions

Types of metaphor that can help a user understand the system easily

- ✓ **Verbal metaphors** are useful tools to help users to understand a new system. These links provide basic foundation from which users develop their mental models⁹.

⁸ Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 510-514

⁹ Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 383

- ✓ Virtual **interface metaphor**: it is for the **Star** system. The overall organising metaphor on the screen was the **desktop**, resembling the top of a real office desk.

GUI design guidelines:

The standard guidelines that a programmer must adhere to during Graphical User Interface design (GUI) are: -

- a) design dialogue to yield closure,
- b) offer simple error handling,
- c) strive for consistency,
- d) reduce short-term memory load,
- e) offer informative feedback
- f) permit easy reversal of actions.

a) Design dialogs to yield closure with clearly marked exits

- ✓ Sequences of actions should be organized into groups with a beginning, middle, and end section.
- ✓ Informative feedback at the completion of a group of actions shows the user their activity has completed successfully
- ✓ If a user selects an unwanted function by mistake, there should be a clearly marked exit point without having to go through an extended dialogue.
- ✓ Undo and redo actions should be supported.

b) Error Handling

- ✓ Errors occur due to incorrect user action(s) such as clicking the wrong link or button.
- ✓ User errors need to be minimized and mechanisms to allow users recover quickly from errors provided¹⁰.
- ✓ Systems should be designed to easily detect and communicate error occurrences through proper feedback
- ✓ There should be a that allows users to reverse the results of an error or to recover the state of the system without blaming users for error occurrences (hostile feedback).

¹⁰ Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg. 30 Pg 313

- ✓ Systems should be designed to accommodate errors and designers must assume that errors will occur and design the system in a way to minimize error occurrences or their effects once they occur.

Role of error messages

When designing a system, it is important that an HCI designer incorporates the element of error messages using programming codes. The role of the error messages are¹¹:

- ✓ Acts as a warning
- ✓ Feedback
- ✓ Shows corrective action
- ✓ Informative

c) Consistency

- ✓ Users should not have to wonder whether different actions mean the same thing.
- ✓ Users feel more confident in exploring the system if they know that the same command or action will always have the same effect.
- ✓ Platform conventions should be followed in system design.

d) Memory Load

- ✓ The system should reduce user memory load.
- ✓ Screen elements should be meaningful and consistent across the system for users to recognize and not remember what the elements mean from one page to another.
- ✓ New items and functions should relate to the ones the user already knows.

e) Feedback

When a user performs an action, he should receive immediate feedback. E.g., upon clicking a button, some screen elements should change as indicator that the system has registered some form of action.

¹¹ Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 479

Content Covered in Week 9: Graphical User Interface

- (i) We have defined Graphical User Interface and related concepts
- (ii) We have described the various HCI interfaces
- (iii) We have discussed the implications of cognitive aspects in designing interactive computing

References

1. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004).
2. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005).
3. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002).
4. Designing the user interface: Strategies for effective human-computer interaction (5th ed.), Shneiderman, B., Plaisant, C., Cohen, M., & Jacobs, S. New Jersey: Prentice Hall. ISBN-10: 0321537351, ISBN-13: 978-0321537355, (2009).